9.—A NOTE ON THE AGE RELATIONS OF THE BASIC PORPHYRITES AND ALBITE PORPHYRIES OF THE GOLDEN MILE, KALGOORLIE, WESTERN AUSTRALIA,

By

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Read 14th November, 1939; Published 16th August, 1940.

Since the publication in 1929 of F. L. Stillwell's bulletin on the "Geology and Ore Deposits of the Boulder Belt, Kalgoorlie" (2) no further note has been made regarding the time sequence of intrusion of the albite porphyries and the basic porphyrites. Stillwell says (2, p. 39) that "while the albite porphyry and the basic porphyrite are closely related rocks in form and occurrence the precise relationship in the time of the relative intrusion is obscure. No clear observation has been made of the intrusion of a basic porphyrite into an albite porphyry." He concludes, from a consideration of indirect evidence, that the basic porphyrites are probably slightly earlier intrusions than the more acid albite porphyries.

Thomson (3, p. 664) considered that there was a close magmatic relationship between the quartz dolerite series and the porphyry dykes and his conclusions are supported by Feldtmann (1, p. 87) and Stillwell (2, p. 60). Stillwell considers that the basic porphyrite and the albite porphyries are magmatically related and that the similarity between the chemical analyses of basic porphyrite and quartz dolerite indicates that they were derived from the same ultimate source. He quotes analyses (2, p. 60) in support of this statement, but from this table it will be seen that he is comparing analyses of rocks which have been metasomatised to a varying degree, one of the rocks containing 8.64% CO_2 whereas the others contain very little. In order to trace any magmatic relation between these rocks it is necessary to compare analyses of types which show the same degree of metasomatism, preferably from the same locality, but failing that, to compare analyses which have a similar CO_2 content. In the following table analyses of members of each of the main types (quartz dolerite greenstone, basic porphyrite and albite porphyry) which show a comparable degree of carbonatisation are set down (all of these analyses are quoted from Stillwell's bulletin):—

	1.	2.	3.
SiO_2	45·03	49·86	61·91
TiO_2	·64	·40	·47
Al_2O_3 ...	9·87	14·93	13·66
Fe_2O_3 ...	4·35	3·22	·81
FeO	11·58	4·34	2·69
MnO	Tr.	·15	·02
MgO	4·26	4·04	1·85
CaO	8·86	6·05	4·11
Na_2O	3·17	4·24	5·03
K_2O	·38	1·65	1·82
H_2O+ ...	1·83	1·40	·58
H_2O- ...	·11	·06	·02
P_2O_5	n.d.	·41	·16
CO_2	8·43	8·64	6·14
FeS_2	·24	·11	·09
Others ...	*Nil*	·10	*Nil*
	98·75	99·60	99·43

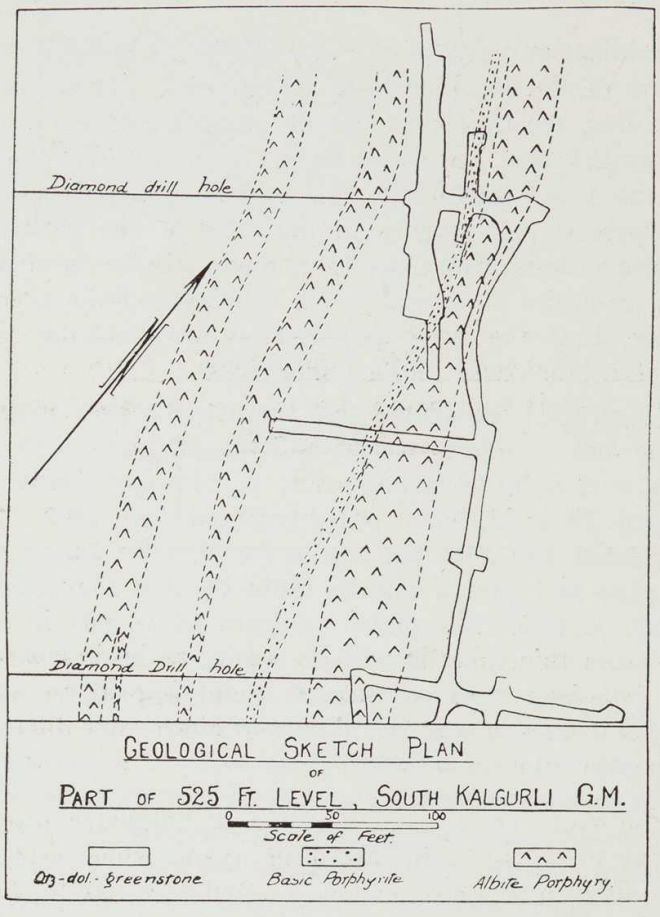
1. Quartz dolerite greenstone. (2, p. 27, analysis No. 2.)

2. Basic porphyrite. (2, p. 40, analysis No. 1.)

3. Albite porphyry. (2 p. 33, analysis No. 5.)

The serial chemical characters of the rocks quoted above point clearly to their comagmatic origin—if they represent successive differentiates of increasing acidity from the greenstone magma, then they would be expected to be intruded in the order:—(1) quartz dolerite, (2) basic porphyrite, (3) albite porphyry.

The author has made several observations on the relationship of the acid and basic dykes which appear to confirm the conclusions obtained indirectly by other observers.

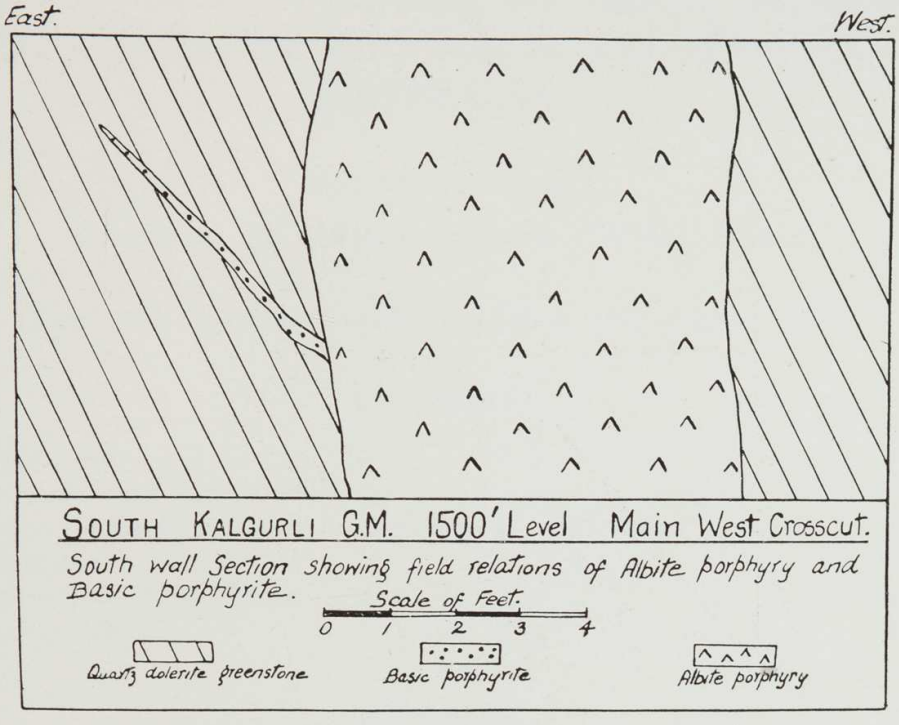


Text Figure 1.

Generally the long narrow hornblende porphyrite dykes run parallel to the wider, more irregular albite porphyry dykes. A typical occurrence is shown in the sketch plan of the north end of the South Kalgurli workings on the 525 ft. level (fig. 1). Here the two dykes are in contact for some considerable distance but do not intersect each other. On the level above (409 ft. level) the same conditions obtain except that the acid and basic dykes are separated by a selvage, one or two inches wide, of bleached quartz dolerite greenstone. The width of the basic porphyrite here is from five to six feet.

Where the basic dykes are more narrow they may be cut by the albite porphyry as shown in figure 2. The occurrence figured is almost at the western end of the main west crosscut at the 1,500 ft. level of the South Kalgurli mine near the South Kalgurli-Enterprise boundary. Here the basic dyke is only two or three inches wide but is well marked and ends abruptly against the larger albite porphyry dyke. The fact that the basic dyke lenses

out to the east side of the section seems to indicate that it was intruded from the west lower side of the section shown and has therefore been cut off by the intrusion of albite porphyry and this establishes their relative age. Unfortunately, the story is only half told by this section, as the lower half of



Text Figure 2.

the basic dyke is not visible but it may easily be on the west side below the floor of the crosscut, in which case it would appear to be older than the albite porphyry. This is, so far as I am aware, the only place where the relation of the two dyke rocks is visible.

The rarity with which the two types of intrusive intersect each other is probably due to the fact that the basic dykes, which are very fine grained and but little affected by shearing, have acted as a bar to the acid intrusions and only the very narrow basic dykes (as in figure 2) have been cut through by the later more acid series.

ACKNOWLEDGMENT.

The author wishes to thank Mr. F. G. Brinsden, General Manager of the South Kalgurli Cons., Ltd., for permission to publish this paper.

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